PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in and relating to Printing Rollers for use in Photogravure and other Intaglio Processes

We, HERBERT EDWIN BOUGHAY, of 85, Woodland Road, Bristol, Gloucestershire, a British subject, and ARTHUR THOMAS ARNOLD, of 5, Falcondale Road, Bristol, Gloucestershire, a British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in printing rollers or cylinders for use in rotary photogravure and other intaglio processes in which the cylinder consists of a permanent base upon which is mounted a readily removable and replaceable thin cylindrical outer member carrying or intended to carry the design. The advantage of such method lies in the ability to store the thin tubular member carrying the design and to remount and reprint same at any occasion without the expense and inconvenice of maintaining a permanent base for each design.

It has hitherto been the practice in the preparation of cylinders or rollers for the above mentioned processes to electro-deposit the layer of metal to receive the design upon the permanent base or upon a layer of material upon the permanent base. The design is subsequently removed by grinding, etching, tearing off the metal layer or detaching the metal layer as a sheet. All these methods involve the destruction of the design or conversion from a cylindrical surface.

It has also been proposed to use copper sleeves forced upon the permanent base by means of hydraulic pressure but such methods are cumbersome and have not been adapted to repeated attachment and detachment of the same sleeve.

It has further been proposed to use thin electrodeposits upon fusible metal cores and after melting out the core mounting the deposit by methods unspecified upon a permanent base.

Comparatively thin cylinders are also in use with expanding mandrels and the like but these cylinders are many times thicker and more expensive than the thin cylindrical member of the present invention.

According to the present invention a metallic tube which has received or is intended to receive the design is so mounted upon a layer of material upon the permanent base that it will withstand the pressure of printing and ancillary operations without movement entirely or mainly by reason of its stress upon the permanent base and without the necessity for retaining keys, dowels, or the like. Such tube, principally by reason of the low frictional coefficient and plasticity of the intermediate layer, being capable of being removed with such freedom from scoring and wear as shall permit the mounting and dismounting of each tube to continue indefinitely.

In carrying the invention into practice the permanent cylindrical base may consist of cast iron, steel or any suitable material, with or without an anti-corrosion surface of nickel, copper or copper-nickel but preferably with a final copper coating. The construction of the base will conform to the requirements of the printing machine.

Applied to the base is a layer of material which is softer and more plastic than the tubular outer member and which material shall posses a low frictional coefficient with respect to that of the material of the member.

Where the outer member consists of copper or its alloys, the material of the layer may with advantage consist of tin, tin alloy or any of the softer bearing alloys.

The intermediate layer may be applied to the base by methods well known in the hot tinning of metal, but it is preferable to apply the coating by electro-deposition using a deposit of tin or one of the numerous tin alloy deposits.

The outer member consists of a metallic tube, preferably but not essentially of copper, produced by drawing, deposition or other known means. This removable tube is intended to receive the design and after mounting upon the base may be ground, polished, etched or otherwise treated in any known manner. For high quality work it is recommended that the tube, if drawn or produced other than by

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electrodeposition, should receive an electrodeposit upon its surface sufficient to accommodate the depth of the design. Any number of tubes may be retained for use with a single base.

The dimensions of the base and tube are so adjusted that the latter is satisfactorily held when mounted upon the former as a shrink fit.

The mounting of the outer tube upon the base is assisted by shrinkage, the tube being expanded by heat and if necessary the base is also contracted by a refrigerant in well known manner. Alternatively the base alone may be contracted by a refrigerant. These dimensional changes permit the tube to slide over the base, but in view of the large size of these shrink fits and the necessity of the base entering the tube coaxially true, we have devised apparatus for mounting and dismounting the said tubes.

The apparatus consists essentially of a spindle threaded for rather more than half its length and provided at a convenient point in its length with a fixed collar, and at one end with a nut designed to engage the aforesaid thread. The opposite end of the spindle is threaded for a short distance and provided with a nut. Cones or bushes of insulating material such as that sold under the Trade Mark "Tufnol," fibre or other suitable material are provided, one mounted at or approximately at a point centrally of the length of the spindle, and another at one end of said spindle, said cones acting as guides for the tube and also as supports for the base, the external diameter of the said cones or the like being equal to the external diameter of the base. Thermal insulating material for the cones is necessary to prevent the absorption of heat from the spindle by the chilled base and to prevent premature chilling of the tube caused by the base. The means for thrusting the tube on to its support comprises a ball race, with which is associated a plate and a recessed ring, the latter being attached to the plate by studs and distance pieces. The maximum internal diameter of the ring is a little more than the bore of the tube and the diameter of the recess in said ring is equal to the outer diameter of the tube.

The procedure in mounting the tube necessarily varies somewhat with circumstances and with the shrink method employed but the following method has been found very satisfactory.

A copper tube .064" thick (16 S.W.G.) is heated and mounted upon the spindle between the recessed ring and resting upon the cone disposed in the centre of the length of the spindle; the cool or chilled base is mounted with its ends upon the two cones and retained by the aforesaid nut at one end of the spindle. The spindle is now rotated, preferably in a lathe while the longer nut is held against rotation by any suitable means, a bar or tommy for example. If the spindle is rotated in the correct direction the nut engaging the longer threaded part of the spindle will rapidly pass up the said spindle and during its movement pushing the tube into its desired position upon the base. When the base and tube reach room temperature the latter will be firmly fixed upon the former.

When the cylinder shall have been etched and printed or for any other reason it shall be desired to remove the cylindrical layer carrying the design the following typical method may be employed.

The cylinder is mounted upon the spindle between the aforesaid cones and secured by the nut upon the shorter screw at one end of the spindle. The nut upon the longer screwed part of the spindle is screwed up until its inner end engages the collar upon the spindle. The ball race is moved to a position towards the outer end of the nut engaging the longer thread of the spindle, the plate upon the said nut occupying a position adjacent the outer end of said nut. This brings the nut ball race and plate close to the centrally disposed collar on the screwed spindle. The recessed ring is reversed and placed in such a position as to engage the outer end of the tube. The ring aforesaid is secured to the plate upon the nut at the other end of the spindle by means of rods preferably passing through fibre rings to hold the tube in position when extracted. The bar or tommy is removed and while the spindle and cylinder is rotated heat is applied to the circumference. When sufficiently heated the bar or tommy is replaced and the nut on the longer thread held against rotation while the spindle is again rotated but in the opposite direction to that in which it is rotated when mounting the tube, causing the nut to travel along the spindle drawing the tube in its passage off its support and bringing it to rest with one end supported by the cone at the end of the spindle, and supported at the other upon the fibre rings previously noted upon the extractor rods.

The heat applied for the extraction of the tube is only intended to be sufficient to expand the tube and is not intended to melt the intermediate layer, although in an emergency this could be done. As a general guide it may be taken that the maximum temperature difference between tube and base in mounting and between cylinder and air in dismounting should not greatly exceed 100° C. In dismount-

ing it is sometimes an advantage to chill the cylinder first before attempting to heat the circumference. In all cases where freezing or chilling is required it is most readily carried out by the insertion of the part to be chilled in a spirit maintained at a low temperature by means of solid CO_2.

When it is desired to reprint any tube which has been dismounted, it is only necessary to mount the tube upon the base as previously described, care being taken that the intermediate layer is in good condition. The intermediate layer, if in bad condition, may be removed by anodic treatment in caustic soda or by the application of a suitable flux while heated, when the base may be recoated as previously described.

As an alternative method to the foregoing, the intermediate layer may be attached as a lining to the outer tube, or the layer may consist of a tube of material.

The outer tube may, if desired, consist of a composite, such as a steel tube coated with nickel and copper, and may receive a wear resisting coating as chromium, nickel, iron or other suitable material, as is commonly employed with printing cylinders.

Dated this 18th day of March, 1936.
J. E. EVANS-JACKSON & CO.,
Agents for the Applicants.

COMPLETE SPECIFICATION

Improvements in and relating to Printing Rollers for use in Photogravure and other Intaglio Processes

We, HERBERT EDWIN BOUGHAY, of 85, Woodland Road, Bristol, Gloucestershire, a British subject, and ARTHUR THOMAS ARNOLD, of 5, Falcondale Road, Bristol, Gloucestershire, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in printing rollers or cylinders for use in rotary photogravure and other intaglio processes in which the cylinder consists of a permanent base upon which is mounted a readily removable and replaceable thin cylindrical outer member carrying or intended to carry the design. The advantage of such method lies in the ability to store the thin tubular member carrying the design and to remount and reprint with same at any occasion without the expense and inconvenience of maintaining a permanent base for each design.

It has hitherto been the practice in the preparation of cylinders or rollers for the above-mentioned processes to electro-deposit the layer of metal to receive the design upon the permanent base or upon a layer of material upon the permanent base. The design is subsequently removed by grinding, etching, tearing off the metal layer or detaching the metal layer as a sheet. All these methods involve the destruction of the design or conversion from a cylindrical surface.

It has also been proposed to use copper sleeves forced upon the permanent base by means of hydraulic pressure but such methods are cumbersome and have not been adapted to repeated attachment and detachment of the same sleeve.

It has further been proposed to use thin electrodeposits upon fusible metal cores and after melting out the core mounting the deposit by methods unspecified upon a permanent base.

Outer cylinders are also in use with expanding mandrels and the like, and it has been the practice, in machines for printing on single sheets, to construct the outer cylinder in the form of a coppered steel tube of about 5 millimeters thickness and to mount it upon a base formed as an expansible cylinder.

It has also been proposed to produce printing forms or surfaces for use in photogravure and like processes by a method which comprises providing on a permanent base a layer of material with which the metal used thereon for the actual printing surface will not permanently unite, and electro-depositing on said layer a thin coating of said metal.

It has also been proposed to secure a cylinder upon a hollow cast iron base of an external diameter which is less than the internal diameter of said cylinder, by first tinning the surface of the base, then placing the cylinder over said base and running an alloy of lead and antimony between said base and cylinder, so that, when said alloy sets and becomes solid, it will hold said cylinder upon the base.

According to the present invention a metallic tube which has received or is intended to receive the design is so mounted upon a layer of material upon the permanent base that it will withstand the pressure of printing and ancillory

operations without movement entirely or mainly by reason of its stress upon the permanent base and without the necessity for retaining keys, dowels, or the like. Such tube, principally by reason of the low frictional coefficient and plasticity of the intermediate layer, is capable of being removed with such freedom from scoring and wear as shall permit repeated mounting and dismounting of each tube.

In carrying the invention into practice the permanent cylindrical base may consist of cast iron, steel or any suitable material, with or without an anti-corrosion surface of nickel, copper or copper-nickel, but preferably with a final copper coating. The construction of the base will conform to the requirements of the printing machine.

Applied to the base is a layer of material which is softer and more plastic than the tubular outer member and which material shall possess a low frictional coefficient with respect to that of the material of the member.

Where the outer member consists of copper or its alloys, the material of the layer may with advantage consist of tin, tin alloy or any of the softer bearing alloys.

The intermediate layer may be applied to the base by methods well known in the hot tinning of metal, but it is preferable to apply the coating by electrodeposition using a deposit of tin or one of the numerous tin alloy deposits.

The outer member consists of a metallic tube, preferably but not essentially of copper, produced by drawing, deposition or other known means. This removable tube is intended to receive the design and after mounting upon the base may be ground, polished, etched or otherwise treated in any known manner. For high quality work it is recommended that the tube, if drawn or produced other than by electrodeposition, should receive an electrodeposit upon its surface sufficient to accommodate the depth of the design. Any number of tubes may be retained for use with a single base.

The dimensions of the base and tube are so adjusted that the latter is satisfactorily held when mounted upon the former as a shrink fit.

The mounting of the outer tube upon the base is assisted by shrinkage, the tube being expanded by heat and if necessary the base is also contracted by a refrigerant in well known manner. Alternatively the base and intermediate layer alone may be contracted by a refrigerant. These dimensional changes permit the tube to slide over the base, but in view of the large size of these shrink fits and the necessity of the base entering the tube coaxially true, we have devised apparatus for mounting and dismounting the said tubes.

The invention will now be described with reference to the accompanying drawings, in which:—

Fig. 1 is a longitudinal section of a printing roller according to the present invention.

Fig. 2 is a longitudinal section showing one form of apparatus for pushing the outer tube upon the intermediate layer carried by the base.

Fig. 3 is a similar view showing the apparatus arranged to remove the tube from the said layer.

Fig. 4 is a sectional view showing certain details.

Referring to the accompanying drawings, 1 indicates a permanent cylindrical cast-iron base.

Electrolytically deposited upon the base 1 is a layer 2 of tin alloy or soft bearing metal which constitutes the intermediate layer over which is disposed the tubular outer member 3, which preferably consists of hard drawn copper.

The tubular outer member 3 is either expanded onto the intermediate layer by the application of heat to the tube, or the base 1 and intermediate layer 2 are shrunk at a reduced temperature into said tube, or in some cases both the tube 3 may be expanded, and the base 1 and the intermediate layer 2 shrunk.

In Fig. 2 is shown apparatus for mounting the tube upon the intermediate layer and for removing it therefrom.

This apparatus consists of a rod 4 screw-threaded, as indicated at 5, throughout approximately two-thirds of its length.

Fixed upon the rod 4 at the inner end of the screw-thread 5 is a collar 6, and rotatively mounted upon the rod and engaging with the thread 5 is a screw-threaded sleeve 7, formed integral with the middle portion of which is an annular flange 8.

Rotatively mounted upon the inner end of the internally screwed sleeve 7 is a plate 9.

Connected to the plate 9 and held in spaced relationship with respect thereto by a series of pins 10 is a ring 11 provided upon its peripheral portion with an inwardly directed annular flange 12, the internal diameter of which flange is equal to the external diameter of the tube 3, the internal diameter of the ring 11 being slightly greater than the internal diameter of the tube 3.

Each of the pins 10 is provided at opposite ends with screw-threads of opposite hand, the thread at one end screwing into

an appropriately threaded perforation in the ring 11 and that at the other end of the rod screwing into a suitably screw-threaded perforation in the plate 9, as shown more clearly in Fig. 4.

Disposed between the plate 9 and flange 8 is a ball bearing indicated generally by 12*a* for receiving thrust between said plate and flange.

Mounted upon the plain portion of the rod 4 with one of its sides abutting the collar 6 is a ring 13 of heat insulating material and mounted upon the outer end portion of the plain part of the rod is a ring 14 also of heat insulating material, the last mentioned ring being retained on the rod by a nut 15 screwed on the reduced end portion 16 of the said rod.

The maximum external diameter of the rings 13 and 14 is equal to the external diameter of the intermediate layer and the opposing faces of the said rings are stepped at 13*a* and 14*a* respectively to receive the ends of the base, as shown in Fig. 2.

The base 1 is placed in the position in which it is seen in Fig. 2 after removing first the nut 15 from the rod 4 and then the ring 14, the base being slipped over the plain portion of the rod and its inner end being placed upon the stepped portion 13*a* of the ring 13, the ring 14 then being replaced upon the rod so that the stepped portion 14*a* thereof enters the outer end of the said base. The nut 15 is then screwed back onto the reduced end portion 16 of the rod to hold the ring 14 in position.

Prior, however, to the placing of the base 1 in position upon the apparatus as just described the tube 3 is slipped over the plain portion of the rod 4 and over the ring 13 to bring the end of the tube into the annular flange 12, the sleeve 7 having been screwed by a tommy bar 17 into such a position that the other end of the tube will then rest upon the outer periphery of the ring 13.

The tube is then heated to increase the internal diameter thereof and while it is still hot the sleeve 7 is rotated by the tommy bar 17 to push the said tube into the position indicated by dotted lines, upon the intermediate layer 2.

Instead of or in addition to the tube being heated as just described, the intermediate layer 2 and the base 1 may be shrunk by cooling prior to the tube being pushed thereon.

To assist the aforesaid heating of the tube 3, the rod 4 is preferably supported at its end in suitable V blocks or bearings so that the said tube may be evenly heated by playing a flame on it and rotating the whole assembly.

The printing roller is then ready for use and is removed from the apparatus.

When it is desired to remove the outer tubular member 3 from the base 1 and intermediate layer 2 the roller is again placed upon the stepped portions 13*a*, 14*a* of the respective rings 13 and 14.

The sleeve 7 is then screwed off the rod 4 and the plate 9 and ring 11 are also removed from the rod and sleeve.

The ball bearing 12*a* is then removed and replaced upon the sleeve, but upon the opposite side of the aforesaid flange 8.

The ring 11 is next detached from the plate 9 by unscrewing and entirely removing the pins 10, after which the sleeve 7 is screwed back onto the rod 4, and into contact with the collar 6, and the plate 9 is placed upon the sleeve 7, as shown in Fig. 3.

The ring 11 is placed over the ring 14 with the flange 12 inwardly directed over the outer end portion of the tubular member 3.

Prior to the ring 11 being placed over the ring 14 a number of fibre rings 18 are slipped over the tubular member 3, these rings each being provided with a series of perforations 19 arranged therearound in spaced relationship, and through which are passed rods such as 20.

Each of the rods 20 is rotated to cause the ends thereof, which are appropriately screw-threaded, to screw into the screw-threaded perforations within the ring 11 and the plate 9 and thus connect said ring and plate.

The sleeve 7 is then rotated by the aforesaid tommy-bar to carry the plate 9 outwardly along the rod 4, and consequently pull the ring 11 along the intermediate layer 2 until said ring has pushed the said member completely off said layer, the fibre rings 18 holding the tubular member in position when it has been so extracted.

In many cases it is necessary to apply heat to the tube 3 when it is removed from the intermediate layer 2 as just described, but such heat is only intended to be sufficient to expand the tube and is not intended to melt the intermediate layer, although in an emergency this could be done.

As a general guide it may be taken that the maximum temperature difference between the tube and base in mounting, and between the cylinder and air in dismounting should not greatly exceed 100° C. In dismounting it is sometimes an advantage to chill the cylinder first, before attempting to heat the circumference.

In all cases where freezing or chilling is required, it is most readily carried out by the insertion of the part to be chilled

in a spirit maintained at a low temperature by means of solid carbon dioxide.

If desired, when the tube 3 is being mounted and dismounted, instead of the sleeve 7 being rotated, as previously described, the rod 4 may be placed in a lathe and rotated thereby, the said sleeve being held against rotation by the tommy bar.

In most cases it is found that the tubular member 3 may conveniently consist of copper tube .064″ thick (16.S.W.G.).

When it is desired to reprint with any tube which has been dismounted, it is only necessary to mount the tube upon the base as previously described, care being taken that the intermediate layer is in good condition.

The intermediate layer, if in bad condition, may be removed by anodic treatment in caustic soda or by the application of a suitable flux while heated, when the base may be recoated as previously described.

As an alternative method to the foregoing, the intermediate layer may be attached as a lining to the outer tube or the layer may consist of a tube of material.

The outer metallic tube may, if desired, be of steel exteriorly coated first with nickel then with copper, the copper presenting the surface to be etched, and after being etched receiving a wear resisting coating, for example a chromium, nickel, iron or other suitable one, as is commonly employed with printing cylinders.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed we declare that what we claim is:—

1. A printing roller of the kind including an outer metallic tube which has received or is adapted to receive the matter to be printed, characterized in that said tube is mounted upon a layer of material compressively stressed between said tube and a permanent base, and which layer has a low frictional coefficient and is of such nature that as a result of its being so stressed it will hold said tube sufficiently firmly with respect to said base to withstand the pressure due to printing and ancillory operations.

2. A printing roller according to claim 1, the base of which consists of cast-iron or steel and the outer tubular member of which roller consists of copper or an alloy thereof, the intermediate layer consisting of tin or an alloy thereof or of a softer bearing alloy.

3. The method of assembling a printing roller according either to claim 1 or to claim 2, by pushing the outer tubular member onto the intermediate layer upon the base, after shrinking said base and layer by subjecting them to a reduced temperature and/or after said outer tubular member has been thermally expanded.

4. The method of assembling a printing roller according either to claim 1 or to claim 2, by applying the intermediate layer to the inside of the outer tubular member, and pushing said outer tubular member with said layer onto the base after shrinking said base by subjecting it to a reduced temperature and/or after said outer tubular member and the layer therein have been thermally expanded.

5. When used for the assembling of a printing roller by the method according either to claim 3 or to claim 4, apparatus for holding the parts of said roller in correct axial alignment and for pushing them onto each other, constructed, arranged and adapted to operate substantially as described with reference to and as illustrated in Figs. 2 to 4 of the accompanying drawings.

Dated this 29th day of August, 1936.
J. E. EVANS-JACKSON & CO.,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1937.

Fig. 1.

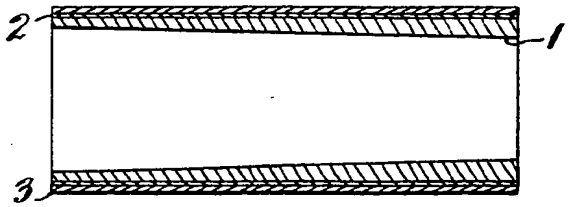


Fig. 2.

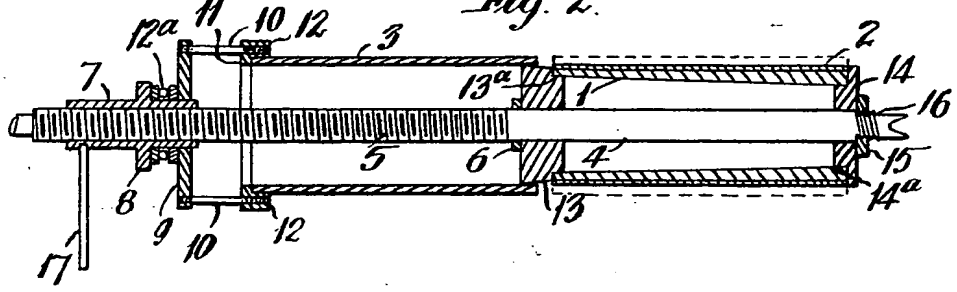


Fig. 3.

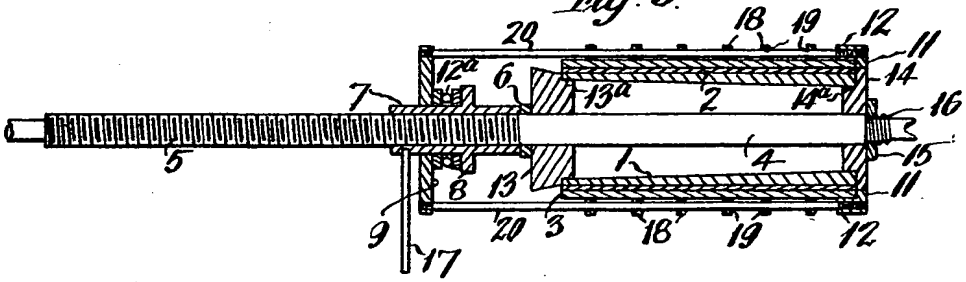
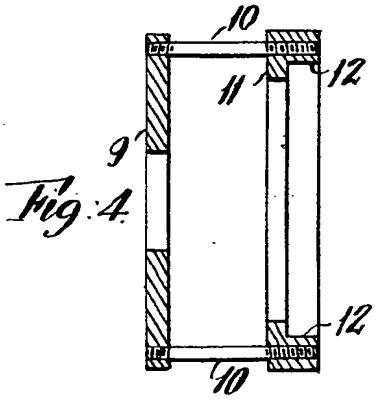


Fig. 4.



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